United States
Department of
Agriculture
Forest Service
Pacific Northwest
Research Station
Research Note
PNW-RN-514
April 1995

Operational Experience at a "Dog-Hair" Site

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Abstract

To monitor consequences of past operational practices, we installed eight 0.05-acre plots in a 9-year-old Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco var. *menziesii*) plantation established after clearcutting a grossly overstocked stand on a poor-quality site. Logging slash was broadcast burned on half this clearcut. One plot sampled the slash-burned portion, and seven sampled the nonburned portion. Of these, two were in areas thinned 3 years earlier by machete combined with pulling smaller seedlings, four were in areas thinned by chainsaw, and one was in a nonthinned strip. Depending on past practices, Douglas-fir seedlings ranged between 300 per acre (burned plots) and 860 per acre (nonburned, nonthinned). Stumps with sprouts averaged 5,665 per acre in saw-thinned plots and only 250 per acre in plots thinned by machete and pulling. Most seedlings and sprouts in the 9-year-old stand were western hemlock (*Tsuga heterophylla* (Raf.) Sarg.). Our data suggest that logging in early summer salvaged seed from the previous year and created favorable conditions for germination and seedling survival. Slash burning in late summer, however, destroyed most new seedlings. The combination of machete cutting and pulling small seedlings proved more effective than chainsaws for reducing stand density.

Keywords: Douglas-fir, western hemlock, stand density, thinning, slash burning.

Introduction

Grossly overstocked (dog-hair) stands are common on the Quilcene Ranger District of the Olympic National Forest in Washington. Such stands typically are found on soils of below-average site quality with a history of extensive wildfires. Naturally regenerated stands and successfully established plantations of Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco var. *menziesii*) frequently become grossly overstocked with volunteer western hemlock (*Tsuga heterophylla* (Raf.) Sarg.) and associated species. For example, 40- to 80-year-old stands average 5,000 to 7,800 stems per acre (Miller 1977, Miller and others 1991).

Portions of one overstocked stand, Ned Puppy Fir unit no. 1, were treated by using various methods. This paper documents results and discusses their implications for silviculture on such sites.

Location and History

The stand, located on the north slopes of Ned Hill and about 7 miles southwest of Sequim, Washington (T. 29 N., R. 4 W., sec. 27), has 5- to 20-percent slopes and an elevation of about 2,500 feet. The site is near the Straits of Juan de Fuca and in the rain shadow of the Olympic Mountains. Douglas-fir site index of the previous 90-year-old stand averaged about 90 feet (base-age 100 years) or site V (poor) (Miller and others 1991). The plant association is western hemlock/rhododendron-salal, characterized by a dry climate, infertile soils, and low timber productivity (Henderson and others 1989).

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The previous 90-year-old stand was a mixture of 50-percent Douglas-fir, 40-percent western hemlock, and 10-percent western redcedar (*Thuja plicata* Donn ex D. Don) by basal area and of natural origin originating after wildfire. At harvest, about 670 trees per acre averaged 9 inches in diameter at breast height (d.b.h.). Estimated Scribner volume was 39 thousand board feet (MBF) per acre. The Ned Puppy Fir unit was logged during winter and spring 1983 as part of a test to determine how to harvest small-diameter trees and chip them on site. Cutting was done with a feller-buncher. Whole-length trees were piled in windrows, yarded by a high-lead cable system, and chipped at the landings. Harvest was completed in May 1983.

Because whole trees were yarded, little logging debris existed within the unit; overall slash loading was estimated at 25 tons per acre. Because slash seemed slightly greater south than north of the road, the 30-acre portion south of the road was burned in August 1983. A carpet of recently germinated seedlings existed at time of burning.[1] This burning killed seed and seedlings.

Preplanting surveys indicated that 600 plantable spots per acre were available in the burned area (fig. 1), based on an 8-foot spacing, and 430 spots per acre in the nonburned area (fig. 2). The entire unit was planted after the 1983 growing season with 2-0 Douglas-fir from seed zone 221 and the 2,500-foot elevation band. Although trees were planted on a nominal 10-foot spacing, density averaged 357 trees per acre over the whole unit.

After the first growing season, a survey conducted on both sides of the road indicated a combined average of 375 crop trees and 163 excess trees per acre. Crop trees were defined as healthy trees, planted or volunteers, and located at least 6 feet from a neighboring crop tree. No browse was observed, but some trees were chlorotic. Based on 25 trees with reference stakes, survival in the nonburned portion of the unit averaged 96 percent. After the third growing season, a second survey averaged 481 crop trees and 2,571 excess trees per acre, thereby indicating increased density. The nonburned area had most of the volunteer seedlings. At that time, one-half to three-quarters of the trees showed browse damage. Survival of staked trees had dropped to 88 percent.

An informal exam in fall 1988 (after the fifth growing season) estimated about 14,000 trees per acre in the nonburned portion. Although these trees were only 3 to 4 feet tall, we reduced stocking at this early stage to avoid greater fuel hazard than would accumulate if we waited and thinned larger trees. The nonburned area was thinned in August 1989 to 306 trees per acre (12-foot spacing) except for a 100-foot-wide, nonthinned strip. The burned portion was not thinned because so few surplus trees existed there. The contractor began thinning with chainsaws, but this caused smaller trees to be shredded rather than cleanly cut. The contract administrator negotiated with the contractor to change methods so that small trees were pulled and larger trees were cut with a machete. These changes proved more effective for eliminating surplus trees. In the following summer (1990), trees in the nonthinned strip appeared yellower and shorter compared to those in nearby thinned portions (fig. 3) and in the previously burned, nonthinned portion.

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[1] Personal communication. 1993. Ernie Meisenheimer, silviculturist, Pacific Northwest Region, P.O. Box 3623, Portland, OR 97208.

Figure 1—The foreground is a portion of the slash-burned area one growing season after harvest and planting; a portion of original, overstocked stand is in background.

Figure 2—This is a portion of the nonburned area one growing season after harvest and planting.

Figure 3—This is a portion of the nonburned area seven growing seasons after harvest and planting. The nonthinned strip is left of stump; a machete-thinned portion is right of stump.

Methods

After the 1992 growing season (plantation age of 9 years), we installed eight 0.05-acre plots. We placed two plots in portions of the plantation that had been thinned 3 years earlier (August 1989) by machete and pulling (plots 1 and 7), and four in portions that had been thinned by chainsaw (plots 2, 3, 4, and 5). Plot 6 was in the nonburned-nonthinned strip, and plot 8 was in the burned-nonthinned portion (fig. 4). After measuring and counting trees, we rethinned two previously saw-thinned plots (3 and 5) by clipping surplus trees at ground level and retaining 320 residual trees per acre. We recorded total number of stems or sprouts of each root system, but measured height of only the tallest stem or sprout. We measured d.b.h. (diameter at 4.5-feet height) to the nearest 0.1 inch of all Douglas-fir and the larger western hemlock per plot and recorded their height to the nearest 0.1 feet. Because multiple stems were frequent, we placed numbered tags only on the tallest stem of each root system.

Results

Although original planting density averaged 357 Douglas-fir per acre, most seedlings and stumps in the 9-year-old stand were hemlock (table 1). Douglas-fir seedlings ranged between 300 (burned plot 8) and 860 per acre. Only a few of these seedlings had multiple stems. On most thinned plots, some Douglas-fir stumps resprouted, but height of these sprouts averaged about half that of seedlings (table 1). In contrast, hemlock sprouts averaged taller than seedlings on each plot. On thinned plots, 60 to 6,920 stumps per acre had live stems contributing additional stocking. Stumps with live stems averaged 5,665 per acre in saw-thinned plots but only 250 per acre in plots thinned by machete or by pulling smaller seedlings (table 1). Stems per stump averaged 1.67 to 2.09 among thinned plots.

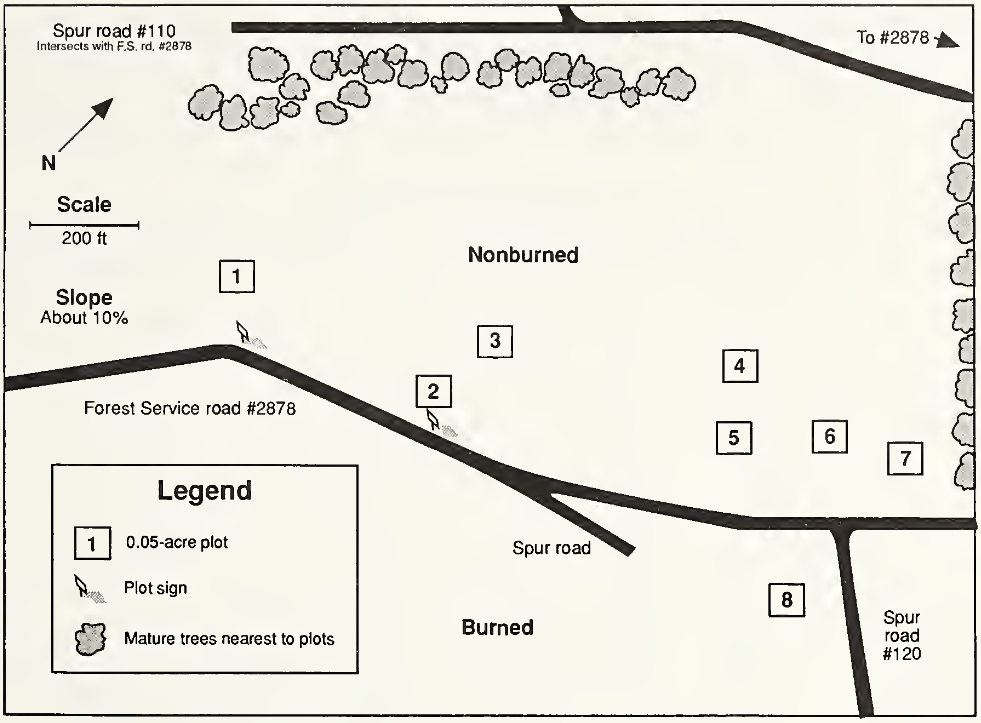

Figure 4—Eight 0.05-acre plots were established after the 1992 growing season. Slash was not burned north of the road, but was burned south of the road, as sampled by plot 8.

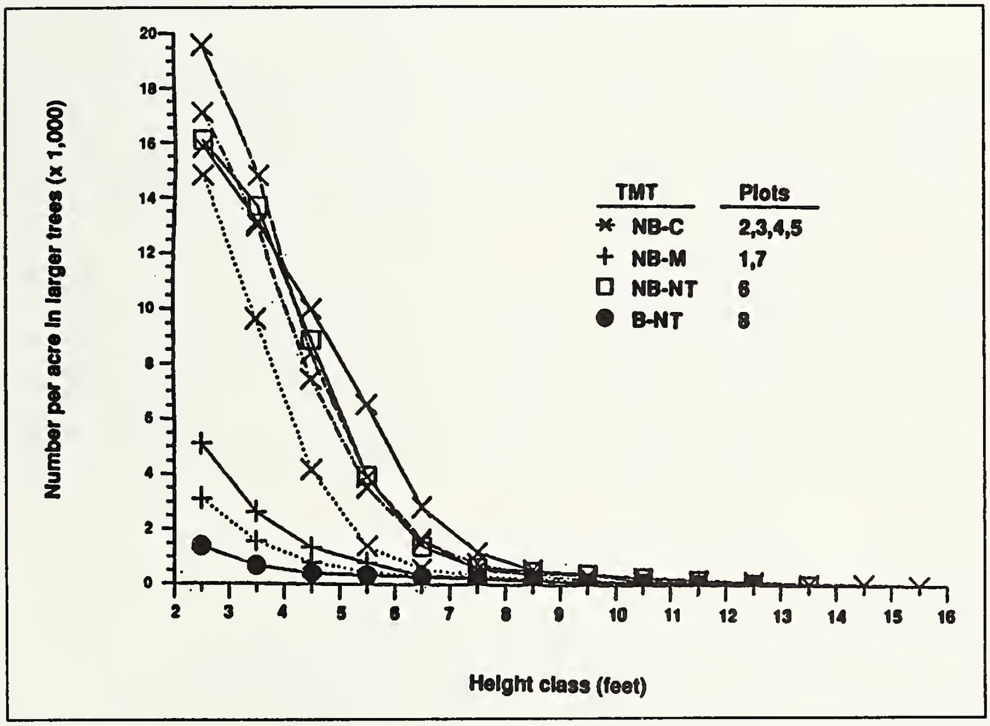

Figure 5—Total number of stems of seedling and sprout origin of all species at age 9, by plot, height class, and past treatment. NB = nonburned, B = burned slash, C = chainsaw thinned, M = machete thinned, and NT = nonthinned at age 6.

Table 1—Stand characteristics by plot and species at plantation age 9 years, per acre basis[a]

		Seedlings				Live stumps				
Plot number	Thin[b]	Stems	Seedlings	Stems per seedling	Mean height	Stems	Stumps	Stems per stump	Mean height	Both
		Number	*Number*	*Number*	*Feet*	*Number*	*Number*	*Number*	*Feet*	*Number*
					Western hemlock					
1	M	3,420	3,140	1.09	2.72	720	420	1.71	3.42	3,560
2	C	4,640	4,320	1.07	3.48	9,680	4,980	1.94	4.52	9,300
3	C	4,660	4,420	1.05	2.53	9,220	4,940	1.87	3.32	9,360
4	C	5,940	5,560	1.07	3.08	13,160	6,880	1.91	3.61	12,440
5	C	5,480	4,680	1.17	3.08	11,240	5,380	2.09	3.76	10,060
6	—	15,440	14,940	1.03	3.67	0	0	—	—	14,940
7	M	2,620	2,500	1.05	2.75	100	60	1.67	3.40	2,560
8	—	1,060	1,020	1.04	2.49	0	0	—	—	1,020
					Douglas-fir					
1	M	860	860	1.00	5.77	40	20	2.00	3.00	880
2	C	780	740	1.05	6.05	400	220	1.82	3.55	960
3	C	520	520	1.00	5.62	180	120	1.50	2.33	640
4	C	380	380	1.00	10.37	40	40	1.00	3.00	420
5	C	320	320	1.00	7.00	40	20	2.00	2.00	340
6	—	640	640	1.00	8.75	0	0	—	—	640
7	M	340	340	1.00	7.00	0	0	—	—	340
8	—	300	300	1.00	8.13	0	0	—	—	300
					All					
1	M	4,360	4,080	1.07	3.31	760	440	1.73	3.39	4,520
2	C	5,760	5,380	1.07	3.76	10,100	5,220	1.93	4.50	10,600
3	C	5,340	5,100	1.05	2.87	9,480	5,120	1.85	3.29	10,220
4	C	6,400	5,980	1.07	3.54	13,200	6,920	1.91	3.61	12,900
5	C	5,820	5,020	1.16	3.31	11,280	5,400	2.09	3.75	10,420
6	—	16,100	15,600	1.03	3.88	0	0	—	—	15,600
7	M	3,020	2,900	1.04	3.25	100	60	1.67	3.40	2,960
8	—	1,400	1,360	1.03	3.77	0	0	—	—	1,360

[a] Includes 1.0 feet tall and taller; mean height averages height of the tallest stem per clump only.

[b] Original thinning at age 6 years, M = by machete and pulling, C = by chainsaw. Plots 6 (nonburned portion) and 8 (burned portion) were not thinned.

Thinning by machete and pulling was more effective than thinning by chainsaw for reducing stand density (fig. 5). On the four initially saw-thinned plots, total stem density and distribution of stems by height class 3 years after thinning were similar to those on the nonthinned, nonburned control plot (fig. 5). Stand density was least on nonthinned plot 8 in the slash-burned portion.

Preliminary plottings of height-d.b.h. relations of crop tree indicated little difference among the eight plots. This suggested that past differences in stand density among the plots had not influenced crop tree growth through plantation age 9.

Discussion

Logging was completed in May 1983 before seed germination. Subsequent observations of many new seedlings and our data suggest that logging in late spring-early summer salvaged seed from the previous year and created favorable conditions for germination and seedling survival. Burning slash in August probably killed viable seed and new seedlings that sprouted in late spring and summer after harvest. Although additional volunteer seedlings have since established in the burned portion, the initial influx of volunteers was killed by broadcast burning.

When the unit was thinned after the sixth growing season, the contractor initially used chainsaws, the conventional tool for precommercial thinning. This proved ineffective because the young stems were so flexible that saws often shredded rather than severed the stems. Moreover, operators often failed to cut below the lowest live branch. Recognizing these failings, the contractor agreed to pull small seedlings and cut larger trees with a machete; this increased quality of thinning. With more trees cut cleanly and lower, there were fewer excess trees surviving and fewer sprouts per stump. Contract cost for thinning 26 acres was $138 per acre. Three years after both methods of thinning, however, many small seedlings still remain that either were not cut previously or germinated after thinning.

The nonthinned portion of the stand is developing an undesirable condition. Cost of delayed future thinning will be high because there will be many stems to cut, and resulting slash may prevent pushing cut trees to the ground. Also anticipated is extreme fire hazard due to the depth of fine fuels. Moreover, residual crop trees are likely to lean and be prone to windthrow due to poor root and stem development resulting from high stand density before thinning.

We believe that early thinning can avert the problem of large amounts of slash that normally result when precommercial thinning in grossly overstocked stands is deferred to a later age. We assume that early thinning also helps stems develop resistance to bending from snow loading or wind, and hence, reduces lodging observed after delayed thinning of very dense stands. The initial early thinning, however, will not keep this stand from a dog-hair condition. Our rethinned plots 3 and 5 should demonstrate benefits of a second precommercial thinning to future crop tree growth and stand structure conducive to wildlife.

Conclusions

Slash burning seems to have controlled the initial number of volunteer seedlings and prevented a dog-hair condition during early stand development. In this grossly overstocked, 6-year-old stand, thinning with a machete combined with pulling small seedlings proved more effective than thinning with a chainsaw for reducing stand density. Managers of sites that characteristically develop dog-hair conditions should document and evaluate their own experience with timing of slash burns and effectiveness of thinning with the chainsaw to reduce overstocking.

Acknowledgments

The authors thank D. Lovato and H. Anderson for field support and computer assistance.

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